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ABSTRACT

Popular and applied business literature related to self-improvement is reviewed in this working paper, one of eight which provide background information for the staff of the Skills Essential to Learning Television Project (a multi-level series of video and print resources for classroom use). A review of theories of time management in section I describes individual, task, and combined approaches and offers recommendations for improving output and avoiding time-wasting. An overview of the operations analysis approach to decision making is provided in section II, and specific techniques for reaching decisions are described. In the third section, methods for improving and increasing memory are reviewed, and simple ways in which memory skills can be applied to vocabulary, reading, and mathematics are listed. The final section considers purposeful mental exercises for clear thinking and improved reasoning. Twenty-four references are listed. (LMM)

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Skills Essential To Learning Television Project:

RESEARCH REPORT

SELF-MANAGEMENT AS AN ESSENTIAL SKILL: WHAT THE BUSINESS LITERATURE SUGGESTS

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The research reported here was conducted by Nancy Malecek Neubert for the Agency for Instructional Television.

SELF-MANAGEMENT AS AN ESSENTIAL SKILL: WHAT THE BUSINESS LITERATURE SUGGESTS

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July 1978

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SELF-MANAGEMENT AS AN ESSENTIAL SKILL: WHAT THE BUSINESS LITERATURE SUGGESTS

Introduction

This working paper for the Essential Learning Skills Project summarizes the extensive body of both popular and applied business literature directed at a "self-improvement" audience. Educators and learning theorists may have some misgivings about the relevance of such literature for fifth and sixth graders; they might justifiably argue that at best these studies are pop psychology misapplied, that at worst business literature could transform students into young bureaucrats. However, two facts remain. Certain skills identified as essential learning skills are very often the same skills that insure effectiveness and success in business; and, practice in perceiving, analyzing, and coping with the world, whether that world is the office, the school, or some common "real" world, is becoming increasingly necessary. Because the business literature is geared toward quick, tangible results, it offers practical, useable methods which could easily be redesigned for the ELS Project.

The practical methods culled from the four areas--Time-Management, Decision-Making, Memory, and Thinking--fall under the general rubric of self-management. Similarities can be seen among the four areas. All, for instance, offer general lists with often interchangeable items for improving skills

(see Mackenzie's 6 steps for time management, p.10; Cooper's 10 steps for decision-making, p. 22; or Flesch's tips for clear thinking, p. 45). Each initially calls for improved alertness and observation to quickly and efficiently assess any situation; yet each balances this quick-and-easy disposal with a caution for a pre-testing process for more complicated situations, a process to avoid impulsive, unthinking action which wastes time and energy, and ultimately causes failure.

Among the suggestions for better decision-making skills are various models and simulations which are continually refined by the proficent decision-maker; the "clear" thinker similarly refines his verbal and mental maps for bigger and better pictures of the situation at hand. Each area of the business literature also suggests games--20 questions, think tanks, elaborate decision-making board games--which make the mental maps fuller and the entire self-management process more enjoyable and efficient.

Along with the various self-improvement schemes, the business literature indirectly proffers an attitude: these skills can in fact be learned. A self-consciousness of all the processes--thinking, remembering, making decisions, using time wisely--makes them more manageable and this in turn generates self-confidence. With this autonomy comes an important complementary skill, the awareness that the maps and models may be incomplete, that other people and other contexts must be considered. Thus the business literature is not feeding a "me" generation's self-serving narrowness, nor is it just proposing an easy-does-it self-confidence. Implicit

in the instruction in the 1-2-3 steps to self-management is the lesson that all situations cannot be managed as simply as 1-2-3. What follows taps the literature for simple coping skills which can be developed into more complex analytical skills, and which may prove useful for the ELS Project.

The ordering of the sections in this paper is somewhat arbitrary, but there is a general movement from the more practical, external self-management skills to the more abstract, conceptual skills. The first section of the paper summarizes the materials on the efficient use of time, with specific recommendations for use in and out of the classroom. With its emphasis on quick perception and comprehension, time management is one of the most basic, most essential learning skills; as such, it serves as an introduction--or prerequisite--for the areas of decision-making, memory and thinking. Section II reviews the materials on decision-making, a larger more involved and practical (or applied) body of literature. Because decision-making is in fact problem-solving, the information presented in Section II may be the most broadly applicable of all four sections to ELS.

The first two sections involve extrinsic operations. The last two, "Memory" and "Thinking," are more intrinsic operations. Much of the literature in fact suggests that memory may be a pre-learning skill. Although memory itself is a difficult and elusive subject to discuss, the business literature does offer ways for increasing memory and ways for applying these skills to vocabulary, reading, and math. Thinking, the subject of Section IV, is, like memory, abstract topic, and the business

literature can, of course, be supplemented with more scholarly research studies. However, the business literature again suggests that abstractness does not preclude practical improvement techniques; some purposeful mental exercises for clear thinking and improved reasoning are considered in the last section of the paper.

SECTION I

TIME MANAGEMENT

This section summarizes the materials on the effective management of time. The first part provides an overview of the "theories" of time management, describing three major approaches, one focused on the individual, one on the task, and the third on both. The third approach differs somewhat from the first two in that the author assumes that a substantial part of time spent is time wasted; the first two approaches start with the assumption that there is never enough time, that the question is really one of frugality rather than waste. The second part of the section presents specific recommendations for improving output and avoiding time-wasters, and also suggests ways these tips can be applied in the classroom and thus incorporated into the ELS Project.

Theories of Time Management

The management of time is the management of a resource; as such, the objective is to increase the output per unit of time. One approach to doing so suggests that greater output can be achieved by improving the ability to perceive the environment and also the ability to understand the nature of the problems encountered (McCay, 1959). The faster one can "get the picture," and the more accurate that picture is, the faster problems can be dealt with and decisions made. This of course implies that more work can be accomplished in any specified period of time.

McCay defines three principal ways to increase perception and comprehension. (It should be noted that his three ways could easily be applied to better decision-making, memory, and thinking, the subjects of the three remaining sections.) McCay first suggests increasing alertness, giving full attention to what is going on. Preoccupation is the lack of alertness and must be fought in order to use time efficiently. According to McCay, preoccupation and habitual, unthinking action can be combated in part by changing routine: some skill, such as playing a musical instrument, can be practiced for some period each day when full attention can be given; or a hobby, such as astronomy, could be taken up because it requires practical yet concerted observation.

Increasing available energy, McCay's second suggestion, is a maintenance skill; with more energy, alertness can be maintained and knowledge and experience more quickly gained. The simplest way to insure necessary energy is to get an adequate amount of sleep. But energy can also be conserved by checking body and environment for "negative factors" -- those that are associated with preoccupation and which sap energy. In making checks for negative factors, the following should be considered: defensive, anxious, or critical thoughts; gritted teeth, clenched fists, physical discomfort; preoccupation with what other people are thinking; distractions in surroundings. These are examples of negative indicators. If they are found, McCay recommends immediately changing the scenery or task; getting a snack, taking a walk, or taking a nap will help protect energy from negative factors. A change in any one activity will change all others as well.

McCay's last recommendation is for increased knowledge and experience, which can lead to an increase in output in the following way. A person selects and arranges sensory impressions on the basis of past impressions, i.e., experience. As experience or knowledge in a particular area is increased, and as much information as possible gathered, a larger base on which to fit new impressions is created thereby giving a bigger or more precise "picture." This ensures faster conclusions, or conversely more complete decisions in the same amount of time. This "big picture," broadened by continual fact-finding, is analogous to the mental maps constantly refined for improved memory; in all four areas discussed in this paper, broadening experience is a key factor.

Other theories of time management do not begin with individuals but rather assume that certain personal characteristics are idiosyncratic, perhaps unchangeable, givens. Such theories suggest that a focus not on individuals but on tasks can increase output over a specific period of time. This can be done by confining efforts to essential tasks, concentrating on opportunities, not problems, and facing the fear of failure. Focusing efforts on essential tasks means being able to state what is to be done, what order of importance each task has, within what period of time it must be accomplished, and how much time is available to complete the task (Engstrom and Mackenzie, 1967). Facing the fear of failure requires (as does McCay's plan) alertness and energy that enable you to accept a challenge rather than relying on habitual negative responses.

By other accounts (Mackenzie, 1972), planning is the essential ingredient in the effective management of time. Planning should be kept simple, but priorities must be assigned--determine where it is you wish to go and how you intend to get there--and follow through with the highest priority items until they are accomplished. By-passing the planning step can produce a self-perpetuating cycle of poor time use. The lack of a plan leads to an inadequacy which in turn produces fear and anxiety that preclude maximum output.

The six steps in effective time use by planning are:

1. Analyze the existing situation, describing it as fully as possible;
2. as a part of the analysis, consider all the assumption in the description.
3. Determine what objectives need be accomplished over a specified period of time, and
4. develop alternative strategies for accomplishing them.
5. Decide on the strategy to be implemented.
6. Finally, review the success of the strategy in accomplishing the stated objectives.

Where a strategy seems to be inappropriate, consider the situation again, with particular attention to the assumptions made about the situation (Step 2); see how changing an assumption changes the choice of strategy, and try again. Assessing the situation, and in turn your responses to that situation, is a skill important to all four areas discussed in this paper.

A somewhat different approach to time management is suggested in Getting Things Done by Edwin C. Bliss (1976). Many of the suggestions offered by Bliss duplicate those of other authors,

although he focuses directly, and somewhat more humorously, on ways to cure procrastination and other time wasters. He recommends screening visitors and callers to avoid interruptions, making decisions quickly, delegating all work that can be, and taking a periodic break for refreshment while working. Bliss says "do not work in clutter," suggesting moreover a cleaning up, or paring down, of the entire working process whenever possible. He also suggests speaking and writing concisely, making certain that the intended message is in fact communicated. Bliss warns that memos should be written only to announce, to remind, to confirm, and to clarify. Bliss says that phone calls or face-to-face meetings are more appropriate than memos for negotiating, carrying on dialogue, and determining consensus. In a similar way, meetings are best-used as occasions to decide, not just consider, agenda items. Students may have few opportunities or requirements for memos and formal meetings, but the communication principle of using the most effective means for the type of communication involved is applicable.

Bliss also recommends after-action reports, a practice borrowed from the military. In the simplest terms, the after-action report consists of two lists: what was done right and what was done wrong. After compiling the lists, consider what to do the next time in order to shorten the what-went-wrong list. Among the possibilities are: starting earlier, making sure communication is good and without misunderstandings, and having an "early warning system" so that problems are noticed as soon as they arise. In addition, have some contingency plans, and be sure to follow through after having delegated a

task to make sure it has been accomplished. Having made mistakes, and having considered alternative ways of handling future occurrences of the same type, do not spend a single minute in regret. Substitute "Next time I'll do it differently" for "If only ...."

Since planning can reduce the total time required for a project, using the last few minutes of the day to plan the next day can be beneficial. These small pieces of time that become available may also be used to plan; in any event, these periods should be used to advantage. For example, the commuting trip, perhaps by school bus for the student, may be turned into a productive period by going over plans or working on some task suited to the restrictions of the trip.

However, good planning means nothing if the planner is also a chronic procrastinator. According to Bliss, procrastination, as a major time-waster, can be dealt with in three ways. One way is by dividing the task into many small sub-tasks--the salami technique. If the whole thing can't be dealt with, a small part of it may be manageable. An asset of this method is that reward often comes quickly upon completing one of the sub-tasks. A second way to handle procrastination is the balance sheet method. Here two lists are made: one, of the reasons for the procrastination, and the other of the benefits to be gained by going ahead and doing the disagreeable job. The effect of this exercise is said to be dramatic. In Bliss's opinion, a third, more fundamental, method to avoid procrastination is changing old habits, systematically developing new ones. The assumption is that procrastination is generally not related to an instance,

but rather is an ingrained behavior pattern. The way to do this is to begin the change immediately by doing something that has continually been put off. By always starting with the most disagreeable item on the "to do" list, you can be pleased with yourself as well as establish a very useful habit.

Another way to overcome wasted time is to overcome fears and mental blocks. When fear is squarely faced it will often go away; therefore, consider the worst that could happen--it may not be so awful! Pretend to be cool and unafraid and proceed just as the cool and unafraid person would.

Mental blocks other than fear may stem from a lack of facts or of conviction. In the first instance, do some more research; in the second, speak to the person assigning the task and attempt to change it. If changing the task is impossible, do it as quickly as possible, and thereafter try to avoid situations where the required work does not inspire conviction. (This must surely be a common situation for students, although they may have limited options for dealing with it.)

Mental blocks may also arise from the size of a task so overwhelming that it is hard to know where to begin. The "salami-technique" is appropriately applied here. Tunnel vision, the source of another kind of mental block, can be cured by gaining a broader perspective, by talking over the problem with others. Fatigue, a cause of all kinds of mental blocks, is of course cured by rest.

Even if blocks and procrastination are overcome, it is difficult to say time is "wasted" without some goals or objectives. Goals are extremely important because they <u>focus</u>

efforts. By specifying goals that are sincerely sought and realistically attainable, the time used can be periodically checked against the objectives. Time is probably not being wasted or mismanaged if the activity is narrowing the distance to the set goals. Bliss insists that priorities should be set in terms of personal goals, not those of others, but again the student may have little opportunity to do so. It probably becomes relatively more important for a student to search for the overlapping areas where his or her objectives match those set by the instructor. Situations of mismatched objectives parallel the situations of no conviction, discussed above.

Specific Recommendations

A number of specific suggestions for improving the use of time were noted from all the literature surveyed, and are enumerated below. When not immediately apparent, comments regarding the applicability for students are included in the parentheses.

1. Use the "quick toss" technique of wastebasketry. (Although perhaps not directly applicable to students, the concept of quick disposition takes on more relevance in conjunction with the second recommendation.)

2. Handle routine matters like correspondence only once. Don't put things back on a pile. Finish things. Think in terms of objectives rather than activities. Do it rather than just work at it.

3. Increase your reading speed; know what not to read. Begin by perusing a book for signs of items useful for your purposes. Read those sections that are relevant, but put the book down when

the material is no longer useful. (A student's reading matter may be prescribed, but for research materials and other supplementary matter, this recommendation would surely hold.) The price of perfectionism is prohibitive. (Students are often encouraged to accept only perfection but a sense of what is personally acceptable is important to develop and may not necessarily contradict the teacher's standards.)

4. Minimize interruptions. Have your calls and visitors screened. (When possible, family members may cooperate in ensuring both.)

5. Avoid distractions.

6. Anticipate problems and delays, and incorporate them in contingency planning.

7. Focus your efforts on fewer jobs. (This may relate to students' decisions regarding extra-curricular activities.)

8. Finish one project before you start another.

9. Organize your work space. Have an attractive physical environment, including an uncluttered desk and noise control; have equipment and supplies handy.

10. Clear your desk of everything not related to the present first-priority task. Don't put anything else on the desk until the task has been completed.

11. Recheck priorities after finishing a task and begin again.

12. When you find yourself preoccupied, change your routine; find an activity you can give your full attention to.

13. Get enough sleep. Exercise. Experiment to discover the minimum number of hours sleep you require to remain alert

throughout the day. Without some tension, however, nothing will be accomplished. But recognize the tension arising from poor time use, and learn to relax as well as achieve a creative state of tension.

14. Ease the tension of work and maintain alertness by taking breaks (get a snack, take a walk, take a nap, etc.).

15. Take an unpleasant task and do it first each day.

16. Divide formidable tasks into more manageable, smaller, sub-tasks. Reverse Parkinson's Law: give yourself a deadline for each task (so that work does not expand to fill the available time). (A useful skill for long-term assignments, homework, etc.)

17. Assert yourself when others' desires and requests conflict with your priorities. (Students may have limited opportunities to do so with teachers and parents, but some situations can be dealt with this way.)

18. Avoid unproductive or trivial decisions or tasks. (Again, students may have limited opportunities to practice this, but it is important that they learn to distinguish the trivial from the important in any case. The ability to discern what is important improves time-management skills as well as decision-making, memory and thinking skills discussed later.)

19. Make a distinction between the urgent and the important. Plan the use of the time you save.

SECTION II

DECISION-MAKING

The recommendations for effective time management are closely related to the efficiency skills described in this section on decision-making. An immediate distinction can be made between the suggestions for personal decision-making skills found in books for business managers and the more sophisticated published works in decision theory that deal with operations analysis. Operations analysis and related tools such as simulation, modeling, and linear programming are highly evolved mathematical accounts of decision situations which provide a means of structuring these situations for analysis and eventual decision-making. Much of applied decision theory deals with organization theory--the ways in which decisions are made and implemented in organizations. The major focus of this section will be on the personal decision-making skills that have been offered as being effective, but some operations analysis methods can be applied to personal decision-making. The first part of this section will present an overview of the operations analysis approach to decision-making; then, with this background, the following part will describe the more specific techniques of reaching decisions.

Operations Analysis and Decision Theory

Operations analysis is based on two fundamental assumptions: One, all operation is considered as an entity (for example,

objects, morale, physical properties and conditions, etc.), and two, nature is rational (Bursk & Chapman, 1963). In effect, operations analysis is the application of the scientific method (Gelatt, 1962); that is, operations analysis is a deductive procedure.

There are four steps from which decision-making proceeds. First is the model, a simplified statement of the predicted relationships among operations. Second is the measure of effectiveness, a consistent statement of goals which provides a criterion, or criteria, for choice. Third is the existence of alternatives which make a decision necessary. Fourth is the experimentation, the process of obtaining information to test the predictions by the model (Bursk & Chapman, 1963). Bross (1953) characterizes the decision process in an analogous way: the process requires a predictive system (the model), a value system, and a decision criterion (effectiveness measure) derived from the value system.

Models allow testing before making a decision, and simulation is one type of model (Jones, 1973). Analysis--or decision-making--can be modeled in a simple decision tree that incorporates alternative events and decisions and the likelihood of occurrence among events. An example is the choice between going to a movie or watching TV, two events, shown as follows:

The probabilities of events and of events' outcomes are not shown on this chart. Operations analysis includes the investigation through mathematical means of the "best" (in terms of predictive ability) set of probability theory under conditions of uncertainty.

Personnal Decision-Making

Decision-making can be understood and improved by first recognizing the ways in which individuals, of finite capacity, simplify complex situations to ones that can be managed. Five common methods have been identified by Yewdall (1969), and are: 1) adopting "rules of thumb," including habits, that reduce the need for constant decision; 2) appealing to a system of categories which reduce information needs by reducing the number of different decisions; 3) suppressing uncertainty, acting on the basis that uncertain events are certain; 4) adopting a near planning horizon as a way to discount uncertainty; and 5) suppressing value conflicts or making spurious resolutions of such conflicts. Several suggestions for decision-making can be gained from this consideration: One is to be aware of the ways in which situations are simplified. In some cases the method may be justified; in others, it may not be. Try to be aware of the dissonance that surrounds complex situations. Make the goals explicit, and do not necessarily equate the desired with the desirable (Gelatt, 1962).

Two books in particular are useful in discussing personal decision-making skills and procedures. They are Decision-Making--A Look at the Process (Miller, 1974) and The Art of Decision-Making (Cooper, 1961).

The general outline for decision-making is simply stated. It requires the identification and testing of alternatives according to specific objective criteria derived from a system of values. The major activity within this process is fact-finding. (The broadly-conceived "fact-finding" discussed here is a complex version of the information gathering recommended for efficient time management.)

Fact-Finding. Fact-finding is acquiring information in order to identify alternatives, their outcomes, and the probabilities associated with both sets of events. Recognizing its central importance, Cooper (1961) offers a number of techniques and considerations. In setting about gathering information, consider first what is to be gathered, and seek the few elements that account for the greatest part of the situation. Decide whether you personally will do the research, and decide how it is to be allocated if others do it.

For efficient decision-making, research must uncover salient information. Seek the one critical factor upon which the decision may turn. A broad view may be used initially but the research should be disciplined so as to focus on the information relevant to the decision. Think about how the information may be indexed, and exploit one lead to find another. (The bibliography accompanying a book or article is useful for this.) Categorize the facts and organize the research into groups of related information; when frustrated, re-sort or reorganize. Finally, look for the relationship among elements in the situation.

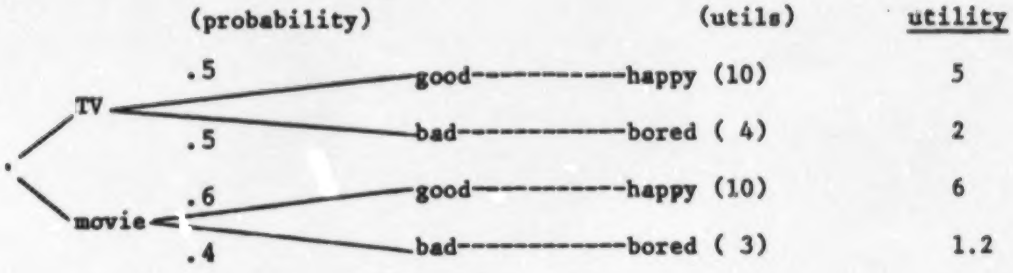
Recognizing what is needed is an important skill for decision-makers. Equally important is the ability to recognize the point where additional research actually provides less useful information than it is worth. Do not go any deeper into the facts than is profitable. As was indicated in the "time management" section, inability to sort and rank facts wastes time and energy. One way to test this is to make a tentative decision as soon as there are facts to support one. The tentative decision should then be tested and additional research undertaken as necessary. When estimating the time required for research, include a safety margin, as research time is generally underestimated.

Values. The values and objectives under which the decision is made should always be assessed (G.P. Miller, 1974). One way to discover just what is important is to write down three or four values thought to be held and the actions taken to implement them. After determining values, state the objectives; to be useful to the decision-maker, objectives must be stated explicitly, and in behavioral terms.

Risk. Each alternative course of action among which the decision-maker must choose involves different levels of risk. That is, the probability of a specific outcome varies with different decisions. Risk can be dealt with by making as many assumptions as possible about the implications, or consequences, of different levels of risk. A systematic approach for appraising risk can also be developed: Specify the risk factors to be studied and weighed. Make assumptions regarding risk and test them for accuracy.

Decision Rule. Among the principles for decision-making are those that are concerned only with the desirability of outcome, regardless of probability. This principle may be either to make the decision with the most desirable outcome or to choose any course other than that with the least desirable outcome. Another principle requiring well-defined objectives on the part of the decision-maker is that of choosing the decision with the highest probability of being successful.

Another decision rule is associated with utility theory, and attaches both desirability and probability measures to outcomes. In the example given earlier, the desirability (measured subjectively in units called utils) is multiplied by the probability for each outcome of good and bad films on TV or at the theater. The decision rule dictates that the outcome with the largest expected utility be chosen.



Aids and Practice Techniques

Decision-making and probelm-solving can be improved by learning the key analytical skills involved in the decision process (Cooper, 1961). These skills are associational perception, elaboration, frame-of-reference facility, generalizing, goal-mindedness, objectivity and skepticism, organizing,

sequential perception, strategic sensing, and symbolizing. A number of these skills are related (to each other as well as to the other three areas of self-improvement skills), and practice techniques below will most likely improve more than one skill at a time.

Involving yourself in as many different activities as possible to extend the range of experience is one means of acquiring analytical skills. Experience can teach what it takes to "get things done," the causes of failure, and the relationship of an action to its broader context. In general, extending knowledge in both breadth and depth extends decision-making ability. (See also the other three sections for specific ways in which experience enlarges the picture and facilitates self-management.)

Clustering is an exercise useful for association perception, generalizing, and organizing. Do this exercise by sitting down with a list of objects or materials and putting related items into the same category. (This is an external version of the mental linking and pairing described below in Section III.)

Develop sources of independent review. This serves as a check on objectivity, as well as providing a test of logic.

Acquire the habit of looking at things. Go beyond the main facts and capture the situation's environment in which to place the key elements. Extended observation aids any of the four suggested skills, again the emphasis is on refining and filling in the big picture, completing contexts and relationships.

Predicting the turn of events is useful and is a skill that can be acquired. Study cause-and-effect relationships, statistical

trends, and other similar situations. Write down the predictions and compare them with the actual result, noting the reasons for deviation from the predicted outcome.

With specific goals, there is more motivation and therefore more inquisitiveness--both important aids to decision-making. A number of strategies can improve inquisitiveness: have specific goals, put yourself in competition with others, commit yourself to having something done by a specific time, get into the habit of asking questions, and take nothing for granted.

Learn how to outline, represent your subject matter in concise form. First decide upon appropriate and useful divisions, such as operational sequence, categories, alternatives, etc. Further division can then be made by reference to notes on the subject. The well-designed outline serves as a model, and shows the relationship between a bit of information and the overlying frame.

Ranking is a means of evaluating alternative decisions, (see "Time Management" for ways in which ranking tasks is a useful time-saver.) It begins with some measure or criterion of values. One way to facilitate the procedure is to write down the alternatives on 3" x 5" cards and arrange them in rank order.

Validating information is yet another technique associated with successful decision-making. Learn to challenge facts in the following ways: 1) ensure that expert opinion is valid--verify the expert's identity, determine the authority by which one is called an expert, discover any known biases, and check the verifiability of expert statements. 2) Check the internal consistency of information given you. 3) Check for observation

errors (first hand, independent corroboration elapsed time, record for accuracy). 4) Be alert to "pseudo-scientific" techniques (equations, diagrams, etc. where they are uncalled for) and fake authenticity (name-dropping, prestige associations, and over-confidence). 5) Distinguish facts from opinions, beliefs, impressions, etc.

Common Mistakes and the Effective Executive

Knowledge of common mistakes, noted by Gordon Miller (1974) and others, may be helpful to those interested in becoming facile in the practice of making decisions. The first mistake Miller notes is failing to choose an action because it was not a known alternative. A second, and related error is choosing an action without knowing its possible outcomes. Next Miller notes the error of misinterpreting the importance of information. A fourth and final mistake is collecting useless or irrelevant data.

Several ways of avoiding mistakes, as well as variants of the decision-making procedures described above, are offered by Peter Drucker in The Effective Executive (1966). Most importantly, Drucker says, don't start with facts. He questions whether there are even such things as facts. Instead, people have opinions which may be treated as untested hypotheses. This view implies a different process from that of the strict fact-finding school. The decision-maker who regards the information about a situation as a set of untested hypotheses is lead to ask what is needed to test these hypotheses. What is a suitable criterion for evaluating the test? Drucker says that to assume the traditional measure is not always the right way, and that one must discover criteria through the process of feedback and constant re-evaluation.

However, errors in decision-making are also caused by a search for consensus. The decision-maker should welcome dissent (in fact, organize disagreement), on the grounds that only disagreement can stimulate the alternatives necessary for considering a decision.

Making a decision when one is not necessary is also a mistake. Doing nothing at all is an alternative, one which must be evaluated with other alternatives for possible costs and benefits.

According to Drucker, there are four elements in the decision process for the "effective executive." First is distinguishing situations which are generic, typical of a general class of situations, from those which are exceptional. Generic situations must be dealt with by a rule or principle. A common source of error for decision-makers is treating a generic situation as if it were a series of unique events. Equally misleading is treating a new event as another example of an old generic situation. Drucker feels there are few truly unique events, and the effective decision-maker is the one who can perceive the underlying similarity among different situations.

The second major element is the clear and precise specification of what objectives a decision must meet. Drucker calls these the boundary conditions or minimum goals. Improper specification of boundary conditions may lead to incorrect decisions.

A third element, perhaps more relevant to business executives than to students, is to state and choose the correct decision

rather than a partially acceptable, compromised decision. Compromise is appropriate and obviously will occur as a decision is carried out. However, stating alternative decisions in their compromise form obscures what makes one decision different and better than another.

Putting the decision into behavioral terms is the last element. Decisions divorced from specific actions are ineffective and probably lead to cynicism among those who hear the words but see no action. Actually expressing decisions in terms that can be implemented may require some reflection on just what is necessary and "do-able."

Summary

The material reviewed here, although differing in approach, does represent a consensus on decision-making procedures. All call for an initial period of information-gathering or hypothesis-testing to generate alternative potential decisions and to determine probable outcomes of potential alternatives. All authors state the need for a clear and precise objective, derived from a value system, against which the efficacy of a decision alternative may be judged.

More than one alternative may further the objective and a decision rule must be used. It may be to choose the alternative with the greatest probability of success, the one that will meet or move toward the objective most efficiently (i.e., provide the greatest gain per unit cost), or the one that will least compromise the objective.

Decision-making skills are analytical skills, and at least one author has ventured that while these can be learned, it is not altogether obvious that they can be taught (Drucker, 1966). Cooper (1961) seems to go farthest in an attempt. The ten analytical skills he identified, several of which can be applied to the three other areas discussed here, were named above. An additional suggestion for developing decision-making abilities that has proven successful for business managers is gaming. Teams of players make business decisions for a firm competing with others for sales or for a specific operational division of a firm. Rules are provided and the effects of specific actions calculated, not unlike Monopoly or various war games. Perhaps a decision-making game has been or could be developed for elementary students and employed with comparable success. Games are suggested for improving time management, memory and thinking skills as well; an important point to be noted is that all these skills can be practiced, and moreover, this practice can be enjoyable as well as instructive.

SECTION III

INCREASING MEMORY

With this section the self-management skills become more intrinsic, more concerned with efficient mental processes than with extrinsic functioning skills. Memory is unquestionably essential to learning, in fact one author goes so far as to suggest that "virtually all learning is based on memory" (Lorayne & Lucas, 1974). The business literature reported in this section suggests that, although less can be said about memory with absolute certainty, memory is a skill, and moreover, a skill which can be improved. This section reviews the methods for improvement as well as listing simple ways in which improved memory skills can be applied to vocabulary, reading, and math.

According to the literature surveyed, association, whether trained or untrained, provides the basis for memory, and refining and practicing the techniques of association lead to increased memory. The principles which underly the successful application of association techniques are attention, interest, and repetition (Young, 1971). Thus things to be remembered must be observed with attention and a certain amount of curiosity, and association can thereby be formed. An association is more likely to be remembered when it has been repeated, when it includes some action, or when it is ridiculous (absurdity and hyperbole can often make an association more memorable).

Methods of Association

Among the methods of association is the memory tab. There are numerous ways of establishing a memory tab, such as associating "port" with "left" and "starboard" with "right." In this instance, the memory tab is the association of the two shorter words (port and left) and of the two longer ones (starboard and right). Another example of a memory tab is the acrostic--the key word ROY G. BIV for naming the colors of the rainbow in order. A memory jog, such as a string around a finger, is another kind of associative memory system. It links something needed to be remembered with something sure to be found, whether it is a knot in a pair of socks or keys in the wrong pocket.

Memory jogs may be used to trigger complete sequences, and thus are related to a somewhat more complicated association technique called pairing. Pairing requires a sense of contexts, relationships, and sequences. It reduces the total number of items to be remembered to half--knowing one item automatically calls forth its mate. A variation of pairing is the visual grouping of items into sub-groups. A list of items may be divided into a number of smaller lists, and items in each smaller list visualized in relation (or association with) each other, in, for instance, a stack or in some animated relationship.

The link system is a further development of sequential, contextual association. The principle of this system is that in order for something new to be remembered it must be linked to something already committed to memory. Thus, a sequence is

formed in which each item suggests the following one. There are several ways to strengthen the links among facts, events, or items to be remembered. One way is to provide an overall theme to the sequence. Another is to make the associations between each pair ridiculous; an unexpected relationship might thus be substituted for the commonly expected one, as in linking a tree and an airplane by imagining a tree flying over an airplane. Another ridiculous but memorable technique is exaggeration -- envisioning items out of proportion or in massive quantities.

A link is made stronger by putting some action into the linking picture, thereby establishing some flow to the sequence of linked events. A useful way to make a link between items is to introduce new information. New data creates interest and will demand attention simply because it is new; the more information available the more there is to associate new facts to. Linking skills, and understanding sequences and relationships, are mental analogs to the pairing and ranking necessary for efficient time management and decision-making.

Related to the linking system is the topical method. Attributed to Simonides and practiced by Cicero, the topical method accounts for the common phrase, "in the first place." By this method of memory, an item or thought is associated with a specific spot or a familiar place, for example, the home. Using this "place plus image" memory technique, a scene is fixed in the mind. The home is a logical place to begin,

but using a familiar neighborhood, small town, or shopping center may provide more niches on which to hang the to-be-remembered items. Because action helps to fix association, a sequence of images that involves active visualizations is preferred. One can extend the application of action to the "place" as well: rather than making a mental tour through a house or around an office, imagine a trip by car. The sequence of events represented by the auto trip provides the "places" to associate images. A good idea is to choose as a place the place where the items to be remembered must be recalled. In this way, the surroundings themselves prompt the image. (More sophisticated memory systems, variants of those described here, may be found in the literature; cf. Young, 1971, chapters 6-10.)

Whatever method of association is used, improving observation improves memory. Young (1971) makes the assumption that meaningful experience is derived from sensations, and that sensations create the observation that is remembered. By fully using the senses, more information about the thing observed is made available, and thus there are more ways by which to index it. Each of the senses can be extended through practice. Learn to <u>see</u> more; learn to <u>hear</u> more. Hearing is a useful supplement to sight, providing an additional dimension that augments the memory. Hearing, as well as the senses of touch, smell, and taste, may be more than supplementary senses. All senses may be considered memory devices themselves, as when the sense of touch is used to type, or when the sense of

smell jogs the memory of what is on the stove. The major methods for improving memory -- observing, building on what is already know, practicing -- are, not surprisingly, very similar to the self-improvement suggestions in the other three sections of this paper.

Reading and Mathematics Aids

The business literature suggests various ways in which memory methods can be applied to increasing "word power." Recognizing a distinction between the speaking or used vocabulary, and the reading or recognition vocabulary, can improve both. Again, the method is linking. Words from one vocabulary are "linked" with opportunities for use in the other. By paying attention, creating an interest, and repeating the words, the link is automatically furnished. Linking is also the key to extending vocabulary through techniques such as watching for phrases of foreign origin. These phrases are associated with a large number of derivative words and phrases, the meaning of which can thus be deduced. In addition, word roots, suffixes, and prefixes can serve as the association for other new words, as can synonyms and homonyms.

Reading speed can be increased by visualizing words rather than by vocalizing them; here the visual linking system is used. Examining reading material for key words or phrases in order to increase reading speed and comprehension is equivalent to the use of memory tabs. Memorizing poetry can be accomplished through looking for links, not only of rhyme, but also of theme.

Just as one reads groups of letters at a time rather than each one individually, groups of numbers can be instantly

recognized in pairs or larger n-tuples. By example, 6 + 3 is immediately known as 9, with no need to compute the sum. In The Magic Mighty Memory (1971), Young suggests a number of other mathematical memory aids for addition, subtraction, division, and multiplication. Exerpts from his chapter, "Use Your Expert Memory in High-Speed Mathematics!" appear below.

5
2
3
4
8
1
3
5

figure numbers, from 1 + 1 = 2, 1 + 2 = 3, up to 9 + 9 = 18. All are instantly recognizable, as they belong to a simple Addition Table, that you acquire automatically by repetition, through adding many columns of figures. So it is easy to "double" them as you run down the column, saying mentally: "9—18—29—36—47—54—61—70—78," totalling the pairs as you go along. That's using memory—already acquired!—to double your speed.

From Double to Triple Speed Through Math Memory Methods

Practice the double speed system as described, using columns of figures of your own, and once you become familiar with it, you will find that it lives up to its title. Thinking in "pairs" is a very easy process, for it is just as natural to regard "3 + 6" as nine as it is to identify "36" as thirty-six. You can take the pairs slowly at first, for there are only half as many to be added, when compared to the old-style single figure addition.

Adding upward is often helpful toward attaining speed. In the example given, you would start with 8 (5 and 3) as your bottom pair; then go to 17 (from the next pair, 1 and 8); then 24 (from the next pair, 4 and 3) and so on to the top of the column. An intriguing exercise is to write out several columns on different sheets of paper; then time yourself by a clock with a second hand, to see how your speed is improving. Or you can do the same with a column of a dozen five-figure numbers, carrying over from one column to the next in the usual way.

You can then go into triple speed by treating numbers in groups of three. This is by no means difficult, as the highest total in such a group is only 27 (9 + 9 + 9) which is one of the easiest to recognize. Taking the sample column already given, adding it from bottom up to top would run: "9—24—38—49—65—78." Here, again, practice is the ultimate factor.

Testing Your Numerical Span in Terms of Instant Memory

Just as reading can be done at different speeds—simplex, duplex, triplex—so can figures be added. There are two differences, however. One difference is: in reading, you are working along the

horizontal; in adding, on the vertical. The other is, that in reading, you are compounding words; while in adding, you are aiming for totals. So it seems odd to compare "reading span" with "numerical span," as though each had something of the same flow. Such, however, is the case. Just as the mind can form a word from a conglomerate of letters, so can it produce a total from a column of figures, all in a flash.

To prove this, have someone write a column of four or preferably five figures on a small pad and draw a line beneath. This is to be laid face down on the table, without your seeing the figures. For example:

5
8
6
2
7

You then take the pad at the lower end, your fingers above and your thumb below, so your hand is palm down. In one continuous action, turn your palm upward, pad and all; then, with a reverse action, turn the pad down again, allowing only sufficient pause for a momentary glance. You will find that you can "read" the figures almost as you would a word. They run through your mind as you add them automatically, just as you might pronounce an odd name like "Jangrig" or a coined word like "Zatrex" if you happened to glimpse them while swinging a corner in a car.

Obviously, it is memory of the instant type that works in both cases, but applied to mathematics, it shows how fleeting impressions can be turned to advantage in rapid calculations. It also shows that groups of figures may be variable where speeded addition is concerned, which paves the way to further rapid processes.

Using "Catch Figures" as a Device in Paper-and-Pencil Addition

5
8
3
2
3
4

Here, starting with a simple column of figures, as shown at the left, you add them downwards, in groups, as already described, but with this sole purpose: To have each group form an individual total between 10 and 20. This speeds the process, since you do not have to add each total to the one before

5
8 – 3
3
2
3
4 – 2

35

6
2
9

7
6
8

(as in the double and triple additions.) It also lets you take advantage of the "memory flow" (as described in the test with the pad).

However, each time your group addition goes over 10, you drop the ten and write the unit as a small figure at the right of the column, marking the last figure in the group. Thus with the column at the left, the additions would run 13 (5 + 8); 12 (3 + 2 + 3 + 4); 17 (6 + 2 + 9); 13 (7 + 6); leaving an 8 unadded. This process is shown at the right.

6
2
9 –7
7
6 –3
8
23
4
63

You are now ready for the follow-up. Run down the column and add all the little figures (3, 2, 7, 3) and to that add the large left-over figure (8), which comes to 3 + 2 + 7 + 3 + 8 = 23. Then run down the column again, counting the number of catch figures only, in this case four, and add that number (4) to your tens column. The tens and units are added (as shown at the right), giving you the answer to the entire addition, which is 63.

Carrying "Catch Figure Addition" to the Tens Column and Beyond

88
48 –6
38
61
98 –7
24
13
62
89 –8

At the left is a column of two-figure numbers to be added downward in "catch figure" style. The units column is added in the usual manner, exactly as shown. Then you proceed to add the tens column in the same way, but set its total beneath and one step to the left. This is illustrated by the process on the right, in which the two totals have been added, giving the result.

88
2– 48 –6
38
61
8– 98 –7
24
13
62
7– 89 –8

23
54

With a column of three-figure numbers, the procedure is continued into the hundreds column; with four-figure numbers, into the thousands and so on. In such cases, the figures of each number should be written fairly well apart, to allow space for inserting the catch figures.

23
54
49
544

Speeding and Assuring Additions by Working from Left to Right

So far, we have departed widely from the old conventional form of addition that begins with the units, carries over to the tens, then to the hundreds and so on, working from right to left. Like spelling out a three-letter word, it is still a good system if there are only a few numbers in the column; but the longer the column, the more irksome it becomes, because of the carry-over. If you forget what you carried, you have to backtrack and sometimes begin all over. Of course, you can write down the figures that you carry, in "catch figure" style, but even that can be avoided if you add from left to right.

Here is a simple example. You want to add the numbers 300, 60 and 5. So you set them down thus:

```
  300
   60
    5
  ---
  365
```

No need to add them from right to left, saying "5 and carry 0; 6 and carry 0; 3." A glance from left to right tells you that it is 365 and you simply repeat, "Three hundred—sixty—five," getting the answer automatically.

How the simple "left to right" rule can be applied to a long and irregular column of numbers is shown under heading "A," below:

```
   "A"
    385
   4172
    248
   3240
    596
    401
   9776
  -----
  16000
   2400
    390
     28
  -----
  18818
```

```
        "B"
      (1)(2)(3)(4)
        3  8  5
   4  1  7  2
         2  4  8
   3  2  4  0
         5  9  6
         4  0  1
   9  7  7  6
  ---------------
1 6*3  9        3rd Col.
     2 4*2  8   4th Col.
  ---------------
1 8  8  1  8
```

340

It's practically the same as 300 + 60 + 5, except the ciphers are added in this case (Heading "A") to form 16,000, 2,400, 390 and 28. In adding those, you naturally work from right to left, as in the old conventional method, because sometimes you will have to carry 1, but never a higher figure, so the summing up is both rapid and rudimentary. To make it even faster, you can proceed as under Heading "B," leaving out the ciphers and putting down the total of the first column; then the second column beneath that; the third column in line with the first; and the fourth column in line with the second.

Summarized, the advantages of these specialized methods of addition are threefold: First, they are speedier and therefore more efficient. Second, a set of figures can be added by one method, then another, avoiding the same slip twice, and thereby providing a sure-fire check. Third, switching from one system to another provides relief from the monotony that frequently comes from adding long columns of figures in the same old way.

By giving each system a regular workout, memory becomes increasingly important, demanding *attention* to each new trial, thereby sustaining *interest*, and providing sufficient *repetition*, but not too much. Again, the A I R formula proves its worth.

Utilizing Memory Methods to Speed Up the Process of Subtraction

As with addition, a Subtraction Table can be formed, so that the difference between any two figures may be instantly recognized. Just as 5 + 3 = 8 in the language of addition, so does 5 − 3 = 2 where subtraction is involved, though the process is somewhat more complex. In adding two figures, it makes no difference which is placed above the other, as:

$$\begin{array}{r} 5 \\ +\,2 \\ \hline 7 \end{array} \text{ or } \begin{array}{r} 2 \\ +\,5 \\ \hline 7 \end{array} \quad \text{Or with larger numbers:} \quad \begin{array}{r} 62 \\ +\,18 \\ \hline 80 \end{array} \text{ or } \begin{array}{r} 18 \\ +\,62 \\ \hline 80 \end{array}$$

But with subtraction, it is customary to put the smaller below the larger, as with the following:

$$\begin{array}{r} 7 \\ -\,3 \\ \hline \end{array} \textit{ not } \begin{array}{r} 3 \\ -\,7 \\ \hline \end{array} \quad \text{OR} \quad \begin{array}{r} 54 \\ -\,45 \\ \hline \end{array} \textit{ not } \begin{array}{r} 45 \\ -\,54 \\ \hline \end{array}$$

However, when it comes to speed subtraction, you should practice working upward as well as downward. Here, the memory factor enters. To you, when your mind is in a subtractive mood, 7 and 3 represent 4; and so do 3 and 7, whether you "read" them from left to right, right to left or downward or upward. But that raises another memory jog that must also be kept constantly in mind. In standardized subtraction, when the bottom figure in the unit column is larger than the top figure, you must "borrow" 10 from the tens column, thus:

$$\begin{array}{r} 43 \\ -\,26 \\ \hline \end{array} \text{ is broken into } \begin{array}{r} 30+13 \\ -\,20+\,6 \\ \hline 10+\,7 \end{array} \text{ giving } \begin{array}{r} 43 \\ -\,26 \\ \hline 17 \end{array}$$

Admittedly, this too is such simple arithmetic that it will prove commonplace to every reader; but here, the memory factor is again involved, and sometimes when something becomes second nature through rote or repetition, the real mechanics of the operation are overlooked. You must be familiar with those mechanics to apply the rules of speed subtraction.

Subtracting Two-Figure Numbers from Left to Right by Instant Sight

Take any two numbers of two figures each, place the larger above the smaller and subtract the left column first; then the right. If both upper figures are larger, this works automatically, as in "A":

"A"	"B"
86	73
−24	−48
62	25

However, if the upper figure on the right is smaller, as in "B," immediately deduct 1 more from the column on the left. That represents the 10 that was "borrowed" by the column on the right. But in this case, you simply "lend" it from the left column to the right, which is a shorter, speedier process.

37

Using Your Memory for Addition as an Adjunct to Quick Subtraction

Most people find it easier to add than to subtract; and if whatever subtraction is required involves only the deduction of the figure 1, it should be easy indeed. So first, let us consider how subtraction can be made easier by preliminary addition; then go on from there.

With any numbers in which only the final figure of the lower number is larger than the corresponding figure of the upper, you have simply to add enough to the lower number to raise it to the nearest multiple of 10, so it ends in a zero. Then add the same amount to the upper number and subtract the lower from the upper. As examples:

75	Add "3" to	78	781	Add "5" to	786
27	both and	30	455	both and	460
48	subtract	48	326	subtract	326

Note that in each case, the upper figure at the right was automatically raised to the point where it represented the final result of the subtraction, due to the lower figure becoming 0. In short, *addition* was used to produce *subtraction*. Now suppose, in the case of 75 – 27, you work from right to left, saying mentally: "7 and 3 are 10; 3 and 5 are 8," putting down 8. Then: "2 and 8 are 10; 8 and 7 are 5 (for 15), less 1, is 4." You would mark down the 4 at the left and have your answer, 48, through addition alone.

The reason for the "less 1" is to conform to the old "borrowing" principle. Now, taking the sample on the right, 781 – 455, you would proceed: "5 and 5 are 10; 1 and 5 are 6." Then: "5 and 5 are 10; 5 and 8 are 3 (for 13), less 1, is 2." Then: "4 and 6 are 10; 6 and 7 are 3 (for 13)." You would mark down 3 to complete your answer, 326. There was no "less 1" in this case, as there was no "carry-over" from the middle column.

Here is the same principle applied to a much longer pair of numbers, in which many of the figures in the lower number are larger than the corresponding figures in the upper:

85732841	
59276376	8
26456463	3

Here is how it would be "broken down" by the "add up" subtraction process in which there are actually no subtractions, other than the "less 1" carry-overs:

(3 − 1)	(6)	(5 − 1)	(6 − 1)	(6)	(5 − 1)	(7 − 1)	(4 − 1)	(3)
8	5	7	3	2	8	4	0	1
5	9	2	7	6	3	7	6	8
(+5)	(+6)	(+8)	(+3)	(+4)	(+7)	(+3)	(+4)	(+2)
2	6	4	5	6	4	6	3	3

All the figures in parentheses are simply carried mentally, adding the bottom row from right to left with each corresponding figure of the top row and then transcribing the total to the answer, below the line.

You Can Multiply Your Memory Power Through Multiple Memory Methods

The chances are about a million to one that you are already well acquainted with the greatest memory device of all time: The Multiplication Table. As commonly learned, running from $1 \times 1 = 1$ up to $12 \times 12 = 144$, the Multiplication Table is in one sense very limited, yet in another, practically unlimited. People who can glibly call off any total up to 12 times 12, may find that they have to "think it out" when asked, "How much is 13 times 14?"

Yet with our familiar decimal system, you don't actually have to go beyond $9 \times 9 = 81$. To multiply by 10, you merely attach a zero to any given number, so that $64 \times 10 = 640$, and so on. The fact that the common Multiplication Table goes as high as 12×12 is a carry-over from the duodecimal system, wherein 12 pence make a shilling, 12 inches a foot, and a dozen dozen (12×12), a gross (144). But all conventional multiplication methods can be reduced to single figures.

Hence there are ways to improve your ability in multiplication: one, to extend the range of the Multiplication Table; the other, to utilize shortcuts or devices in the multiplication process itself. Each of these requires individual consideration as a way to multiply your memory power.

Expanding the Multiplication Table to Speed Specialized Calculations

Expansion of the Multiplication Table is a great help to accountants, salesmen, insurance agents, storekeepers and many other persons who must be prompt in coming up with the right figures or estimates when occasion so demands. The question is: How far should it be expanded? The answer, in most instances, depends on individual needs and inclinations.

The simplest course is to refer to such a table and go on beyond the multiple of 12, say to 15. That's almost automatic up to $13 \times 6 = 78$ and higher multiples such as $13 \times 11 = 143$ and $14 \times 11 = 154$, which follow an established pattern. The difficulty comes with higher numbers, such as $1 \times 13 = 13$, $2 \times 13 = 26$ and so on up to $13 \times 13 = 169$. However, by extending the lower multipliers first, you will be that much ahead when you reach the higher brackets.

For example, having extended your 7's to $15 \times 7 = 105$, and your 8's to $15 \times 8 = 120$, and your 9's to $15 \times 9 = 135$, you will be going over familiar ground as you commit your 15's to memory and come to $7 \times 15 = 105$, $8 \times 15 = 120$, $9 \times 15 = 135$. So if need and inclination provide sufficient urge, it is simple enough to expand to 20×20 or 25×25.

That will require time, however, for this is one case where you must revert to rote, in order to have the exact answers on immediate call, just as with the common Multiplication Table up to 12×12. There are, however, some specialized cases that require less effort. A printer, for example, thinks in terms of 16's as well as 32's and 64's, as printed sheets fold into pages composed of those numbers. So he can multiply by 8's, adding a doubling process; or, being so familiar with 16's, 32's and 64's, he can commit their tables to memory as far as needed, without worrying over the intervening stages.

How a New Look at Number Groups Enables the Rapid Calculator to Shine in Business

Since the great advantage of an expanded Multiplication Table is the aid it gives to business, it is quite obvious that any other

Putting Multiplication Methods in Reverse to Speed the Division Process

Oddly, where division is concerned, the Multiplication Table is of prime importance. Yet actually, this is not as odd as it might seem. Multiplication and division are definitely interchangeable: When you think that $7 \times 6 = 42$, you automatically realize that $42 \div 7 = 6$. So familiarity with the Multiplication Table, sponsored by *attention*, sustained by *interest* and driven home through continued *repetition*, becomes a tremendous adjunct for division as well. That is a good reason for extending or expanding the range of the Multiplication Table, as already recommended.

There are, however, special rules regarding the divisibility of numbers; and if these are studied, with due consideration, and then gone over sufficiently, they can be so committed to memory by the A I R process that they will be constantly available for future reference. Those are:

A number can be exactly divided by:

2—if it ends in an even number (as 24, 38, 90).

3—if its figures add up to a number divisible by 3 (as 27 or 168).

4—if the last two figures are divisible by 4 (as 228).

5—if the last figure is 0 or 5 (as 100 or 37,295).

6—if divisible by both 2 and 3 (as 28,434).

8—if the last three figures are divisible by 8 (as 769,104 or 22,136).

9—if all the figures add up to a number divisible by 9 (as 325,638 = 3 + 2 + 5 + 6 + 3 + 8 = 27).

10—if the number ends in 0 (as 20, 350, 1,630).

12—if divisible by both 3 and 4 (as 6,264).

Determining divisibility by 7 is an extremely complicated process and determining divisibility by 11 is somewhat difficult for general use, so those have been omitted from the list.

SECTION IV

CLEAR THINKING

Previous sections in this paper have examined the suggestions to manage time better, improve decision-making abilities, and increase memory. This section concludes with suggestions for better thinking, another complex process which, like memory, can be improved by certain techniques, according to the business literature surveyed. Of the books examined, three employ a similar method: The Art of Thinking (Dimnet), How to Develop Your Thinking Ability (Keyes), and The Art of Clear Thinking (Flesch). All suggest that thinking is most easily described by analogy. Dimnet sees thinking as images, inseparable from or produced by thought. According to Keyes, knowledge and memories are mental maps and thought is the act of creating those maps. Flesch defines thinking as memory or experience.

Having described thinking in these ways, each author develops the method for clear thinking derived from his analogy. Dimnet (1928), who finds thinking to be inseparable from image-making, claims that obstacles to thought are those that inhibit imagery. They include "obsessions or inferiority complexes" sometimes produced by education itself and/or by a bad environment. Clear thinking (i.e., image-making) is based on a life of "exterior" and "interior" solitude. Exterior solitude is learning to be yourself; interior solitude is learning to concentrate.

("Concentration is less a gift than a habit.") To achieve a condition of high thinking you must live your life on a higher, "concentrated" plane.

Dimnet's approach may seem simplistic and outdated, but the book remains on at least one list of suggested reading for executive development. And some of his ideas, including the suggestion that thought be defined as an image-making process, could be applied to the ELS project. He postulates, for instance, that interest of any kind naturally produces concentration, and that the art of thinking is largely the discovery of that which satisfies the intellect "without effort or restlessness." This may suggest the utility in encouraging students to be self-conscious about their thinking and about their interests. In teaching better thinking, educators may also be helping students make career decisions that are compatible with the way they think and thus more satisfying.

The central question for Keyes (1950) is "do my verbal maps adequately represent the territory?" Verbal maps are based on knowledge and experience, and formed through the process of thinking. In fact, to Keyes, knowledge and memories are themselves maps, although unrefined. The quality of thought depends on how well it produces maps that facilitate successful predictions. Keyes recommends that maps, and therefore predictions, be supplemented with observations. Observation allows adjustments in verbal maps, thereby providing an increasingly refined predictive tool.

There are six specific ways in which maps should be adjusted by actual observation, specific things to be kept in mind when employing maps for predictive purposes. 1) Maps are never complete; you must keep an open mind. 2) Situations in the world are not dichotomous -- black-and white or either-or; things vary, you should recognize the limits to the applicability of any map. 3) To some extent experience, knowledge, and observation are tempered or influenced by the recipient, thereby distorting the isomorphism of the mapping. In using maps, you must recognize their limitations and the fact they may be only your representations. 4) The distance from which an object is viewed or considered can mislead you in making predictions. You cannot make statements about individuals from generalizations; conversely it is dangerous to generalize on the basis of a single or a few observations. 5-6) In applying a particular map you should verify it, make sure it is relevant to the situation at hand, to both time and place (environment). These six points are summarized in six catch phrases which may be quite useful to the ELS project:

1. So Far as I Know
2. Up to a Point
3. To Me
4. The What Index
5. The When Index
6. The Where Index

Keyes has included an appendix to his book on teaching these six points to children. He suggests that these "tools for thinking" can easily be illustrated in ways that children can understand. (See Keyes, Appendix I, pp. 239-40.)

In saying thinking is the manipulation of memories and experience, Flesch does not differ very much in his approach from Keyes. Rather than maps, however, Flesch puts memory and experience into words and language. Language is a part of a system of thinking, and words express patterns of experience. As language is handed down, so also is a pattern of thinking and feeling. (See pages 51-3 for a challenge to the implicit assumptions about the nature of language and perception.)

The art of clear thinking is the skilled use of language in thinking -- the better you are with language, the better you will be able to think. Because language provides the form or vehicle for thoughts, and the more precise the word, the more precision in thought. You can gain facility in thinking and language by translating ideas from one set of words to another. If you can paraphrase successfully, you most likely have the ideas and not simply the words. The very act of detaching ideas from an arbitrary set of words and finding another set requires productive thought.

According to Flesch, learning to spot logical fallacies -- formal, verbal, and material -- also enhances clear thinking. A formal fallacy is the incorrect application of the syllogism technique; a verbal fallacy, the tricky use of words; and material fallacies, the inclusion of irrelevant points and/or the omission of relevant ones. Verbal fallacies may be avoided by distinguishing between the abstract and the concrete, and material ones by asking "so what?" and "specify." Fallacy spotting would seem to be tremendous importance to the ELS programs.

Among other ways Flesch offers to improve thinking skills are puzzles (the first step to alleviate confusion is always rearrangement) and to read whodunits. The game of "20 Questions" is the "model of productive thinking"; learning to use the method well, without making wild stabs, by asking questions with an equal chance of being answered yes or no, and by using varied and creative classifications, can furnish you with an invaluable aid to thought. As in the other areas, gaming is not only enjoyable, but also an extremely productive practice strategy.

In conclusion Flesch offers a list of "reminders for clear thinking." The list includes:

1. Try to remember that everyone, including yourself, has only his or her own experience to think with.
2. Try to detach your ideas from your words.
3. Translate the abstract and general into the concrete and specific.
4. Don't apply general rules blindly to specific problems.
5. To solve a puzzling problem, look for a seemingly irrelevant key factor in the situation and for a seemingly unsuitable pattern.
6. Narrow the field of solutions by asking 20 Questions.
7. Remember that "bright ideas" are often wrong and must be tested.
8. Don't underrate the influence of chance.

Among businessmen as well as educators, the theories of John Dewey are being reinvestigated. Dewey provides a somewhat different approach to teaching thinking in his 1933 book <u>How We Think; A Restatement of the Relation of Reflective Thinking to the Educative Process</u>. To him,

> *the training of thought can be attained only by regulating the causes that evoke and guide it. ...Habits of reflective thought are formed through establishing conditions that will arouse and guide curiosity; of setting up the connections in things experienced that later will promote the flow of suggestions and create problems and purposes that will favor consecutiveness in the succession of ideas.* (Pp. 56-7)

In the instruction of thought, certain native resources should be applied for the development of good thinking habits. They are curiosity, suggestion, promptness, variety, and profundity. Not only "native resources" but also manual training is called for. Such training should be a part of instruction for forming "alert, persistent, and fruitful intellectual habits."

Language is also necessary for training thought. Although Dewey, unlike Flesch, does not equate language with thought, he finds it necessary for thinking, as a "conscious tool of conveying knowledge and assisting thought." Developing language in this way requires enlarging the vocabulary, making it more precise, and forming habits of consecutive discourse. The school can unfortunately preclude the development of the last by teacher monopoly of discourse, assignment of lessons that are too short, and an insistence on avoiding error.

Dewey also speaks of the place of observation and information in the training of the mind for thinking. Thinking is the act arranging subject matter, or information, in order to discover what it signifies. Pupils should learn "to observe for the sake of finding out what sort of perplexity confronts them, conjecturing and inventing hypothetical explanations for the puzzling features revealed by observation, and testing the ideas suggested."

Again, as in all other sections, observation broadens the picture and is thus of fundamental importance.

Dewey proposes that arousing curiosity, making vocabulary both larger and more precise, and observing and ordering information -- guiding, refining, arranging -- produces consecutive thought. In addition to these traits, a sense of the problem that observation will help define and solve is necessary. Without it, observation is intellectually ineffective. This perspective on teaching thinking seems to suggest general approaches and emphases for the ELS design team rather than specific tricks to employ. In particular, it appears that Dewey has noted constraints on curiosity and discourse which should be avoided.

A third set of ideas on thinking comes from Edward deBono's Lateral Thinking for Management; A Handbook of Creativity (1971). Lateral thinking is generative and creative; rather than following the strict procedural steps of logical (i.e., vertical) thought, deliberative jumps can be made. Thinking itself is the process of changing the nature of information received by the brain. The basic lateral thought process is reacting to information. In the first stage of thinking, you "divide the situation into concepts, feature, factors, effects and other perceptual parcels not themselves created by the application of special techniques, but by the natural patterning processes of the mind. (Such sorting processes are defined as important in the other three self-management areas.) In the second stage, algorithms are used to process the concepts and arrive at a

solution." Problems arise in the first stage, when many times the problem is to define the problem.

An outline for thinking is as follows. First, wait, then collect information to expose yourself to the circumstances; do this in an active, not passive, way. Borrow ideas and ways of reacting from others who appear to be in a similar situation. Organize and process incoming information. Finally, clarify your thoughts by setting them down on paper or using another person to reflect them to you. DeBono offers six suggestions for productive lateral thinking: 1) Be conscious of the process; 2) spend some time on it; 3-4) develop attitudes and tools for reacting to and modifying information; 5) be aware of mistakes; and 6) escape from inhibiting procedures by searching out alternative ones.

A spin-off from deBone's lateral thinking method is "The Think Tank" (see advertisement, p. 49). The Think Tank is a sphere containing 13,000 words. The sphere is tumbled and the few visible words are the keys for further thought about the problem at hand. "They will suggest new routes and provoke the happy accidents on which new ideas are built."

The following "hints for thinking," compiled from all the literature surveyed, serve as a convenient summary of all the methods offered.

Hints for Thinking

1. Learn to concentrate.
2. Consider everything as a problem.
3. Enlarge your vocabulary.

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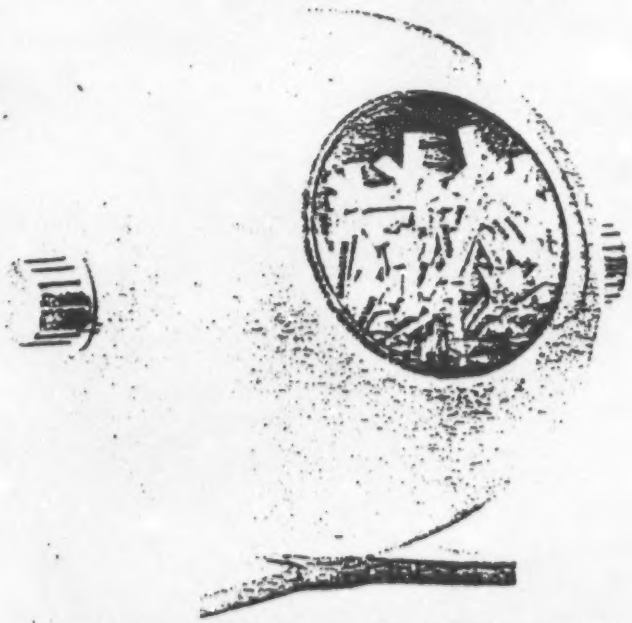

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4. Make your speech more precise by avoiding vagueness.
5. Form the habit of consecutive discourse.
6. Keep an open mind; say "so far as I know."
7. Recognize things are not black and white; say "up to a point."
8. To some extent we create our own facts; say "to me ..."
9. No two things are alike in all respects; think in terms of individuality.
10. Things change; specify when you are talking about.
11. Environments differ; specify where you are talking about.
12. Distinguish between the abstract and the concrete.
13. Train yourself in clear thinking by reading whodunits.
14. Detach your ideas from your words.
15. Don't apply general rules blindly to specific problems.
16. Take notes and keep files.
17. Discuss the problem with others.
18. Don't be afraid of the ridiculous.
19. Know the time of day when your mind works best, and arrange your schedule accordingly.
20. When you get an idea, write it down.
21. Surround yourself with the tools for thinking, including reference works, manuals, newspapers, etc.

The final group of sources to be reported are articles from two edited collections: one, Thinking and Reasoning (Wasson and Johnson-Laird, 1968); the other, Language in Thinking (Parveen, 1972). These two sources consist of research reports by psychologists studying reasoning/thinking processes, and are, in general, less applicable to the ELS project at hand because their

information is not applied. A number of articles were, however, interesting, and their conclusions will be restated here simply as a collection of thought-provoking new issues.

1. Chapman and Chapman (in Wasson and Johnson-Laird) failed to find an atmosphere effect in syllogistic reasoning. The atmosphere effect is a drawing of conclusions on the basis of the global impression of the premises.

2. Helne, in the same collection, investigated whether or not errors in deductive reasoning mean the logical process has been violated. Or, is it possible that a logical process of some sort is discernible even when the reasoning leads to error? He found that subjects often erred because they had worked with materials differently or they had undertaken a different task from those intended. Considering the materials and tasks as they were understood by the subjects, Helne failed to find evidence of faulty reasoning. He suggests that motivational influences may act on reasoning, affecting the materials with which thinking works more than distorting the reasoning process.

3. "The tendency to form inductive generalizations is an asymmetric function of the evidence form," write Gilson and Abelson (Wasson and Johnson-Laird). Objects were more freely generalized than subjects. Persons were found to generalize more readily where the negative form of the verb did not imply a very negative relationship between subject and object and where the verb lead to a holistic impression of the subject class.

There have been numerous attempts to answer the question, "Does the structure of a given language affect the thoughts,

memory, and perception of those who speak it?" But many of those attempts have been flawed, according to Lennenberg (Adams, 1972), because translation invalidates the attempt to demonstrate cognitive differences as evidenced in two or more languages. Translation distorts the significance of forms of speech where the literal meaning is not relevant or meaningful in its common usage or where the sum of general meanings of words in a sequence is not at all "the global meaning of an utterance."

Piaget's stance ("Language and Thought from the Genetic Point of View," in Language in Thinking) is best summarized in his own words:

> *... Language is not enough to explain thought, because the structures that characterize thought have their roots in action and in sensorimotor mechanisms that are deeper than linguistics. The more the structures of thought are refined, the more language is necessary for the achievement of this elaboration. Therefore language is a necessary but not sufficient condition for the construction of logical operations. It's necessary because without the system of symbolic expression that constitutes language the operations would remain at the stage of successive actions without ever being integrated into simultaneous systems or simultaneously encompassing a set of interdependent transformations. Without language, the operations would remain personal and would consequently not be regulated by interpersonal exchange and cooperation. It is in this dual sense of symbolic condensation and social regulation that language is indispenable to the elaboration of thought. Thus language and thought are linked in a genetic circle where each necessarily leans on the other in interdependent formation and contains reciprocal action. In the last analysis, both depend on intelligence itself, which antedates language and is independent of it.* (P. 179)

In the same volume, a piece by Vygotsky ("Thought and Word") seems to follow the Piagetian stance. Vygotsky has found no specific interdependence between the genetic roots of thought and of word, and considers the relationship to be a product of and not

a prerequisite for "the historical development of human consciousness." The relation between thought and word in the mature mind is not a thing, but a process. Piaget's and Vygotsky's work on the relationship between thought and language is more complex than that by Flesch and others, and not always intended for a popular audience. The implications are important, however, and should provide important balance and cues for the ELS project.

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